

The management of outbreaks of smallpox, diphtheria, and scarlet fever.^a

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GENTLEMEN: I have been assigned the duty of addressing you upon the subject of "The management of outbreaks of smallpox, diphtheria, and scarlet fever" from the standpoint of the municipal, local, and rural health officer, a subject full of importance and pregnant with the most vital interests of the community in which you live.

SMALLPOX.

Without further preliminaries I would beg to enter at once upon the subject of smallpox, and in considering its management I beg to consider not only the management of epidemics when they have once made their appearance, but the prophylaxis or prevention of such outbreaks.

Prevention.—In all communicable diseases there are various means at our disposal for the control and prevention of their spread. Such certainly is the case with smallpox; but I think it admits of no argument that were we limited to one method for the prevention of the spread of smallpox that method would be vaccination.

Into the subject of vaccination it is hardly necessary to go before an audience of this character. What the nature of vaccinia is—whether vaccinia is smallpox in the heifer—may be subjects full of interest, but I do not consider that their discussion, however important, properly belongs to an occasion like this. Much prejudice in the past has existed against vaccination, which *might* possibly have been justified in the days of arm-to-arm vaccination or vaccination from the scab. I can conceive that it is possible that certain constitutional diseases, viz, tuberculosis or syphilis, might be conveyed by these processes; but practiced as vaccination is to-day, with bovine lymph, and that lymph largely purified of extraneous organisms and contaminations by the process of glycerination, such untoward results are now of infrequent occurrence, and it is high time, in this third year of the twentieth century, that the prejudices against this most

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valuable prophylactic should disappear with the advance of education and intelligence. Of course, it is essential that vaccination should be carefully performed. The arm—or leg, in the case of females—upon which vaccination is practiced should be cleansed by soap and water, followed by alcohol. The scarification should not be large; a spot of one-eighth inch in diameter is sufficient. The vaccine should be glycerinized, and care should be taken to prevent its contamination. As soon as the lymph has dried some light protective dressing should be employed to prevent contamination of the area by pus organisms, either rubbed in by the fingers or the dress from the surrounding area.

Having placed vaccination thus in the first place of importance for the prevention of smallpox, it might well be asked what measure takes the next place in importance in the prevention of this disease. I answer, after mature deliberation and consideration and hope that it will meet with your approbation, that thorough, early, diagnosis in my opinion easily takes the place of next importance.

Diagnosis.—Smallpox may be mistaken for several other conditions, viz, measles, scarlet fever, chicken pox, syphilis, or impetigo contagiosa.

A few words as to the differential diagnosis of these maladies will not be out of place.

In *measles* the period of incubation is a little longer than in smallpox (about fourteen days). The stage of invasion resembles an ordinary cold, attended with shivering, not often with definite chills, sneezing, injection of the eyes, running of the nose, and a more or less severe cough. The eruption makes its appearance upon the fourth or fifth day, and the condition of the patient is not materially improved with the appearance of the eruption. By the sixth day the eruption is well developed and gradually fades, though coming out in successive crops. There is no secondary fever with the appearance of the eruption.

In *scarlet fever* the incubation is much shorter, ranging probably as high as seven days, about four days on an average, and the period of invasion is attended with high temperature and more or less sore throat, generally a very considerable sore throat. The eruption appears on the second day and is in the form of a bright red scarlet rash in which there are spots of more or less deep mottling, giving a particularly red appearance, with marble streakings. The tongue has a strawberry or raspberry appearance, owing to the projection of the papillæ of the tongue. Albuminuria is a frequent complication of scarlet fever.

Chicken pox or *varicella* might be strictly called a disease of children, though it sometimes occurs in adults. The period of incubation is rather long. The initial symptoms are somewhat mild and frequently attract little attention, though there may be fever, vomiting, and pain in the back and limbs. The eruption appears within the first twenty-

four hours, being first papules, which in a few hours change to pustules filled with a gray though generally turbid fluid. In three or four days the eruption dries up and forms scales which fall off, and the scarring, if any, is very superficial. It is to be noted that the scabs of chicken pox are generally bloody in character. It is possible that varioloid may be mistaken for chicken pox.

Impetigo contagiosa in outward appearance approaches nearer to chicken pox than smallpox. The eruption is without constitutional symptoms and occurs in groups or patches. The patches coalesce and as desiccation takes place large crusted patches are formed.

Syphilis in some of its protean aspects resembles smallpox. In this disease we must be guided by the *history of the case, which is the strongest point of differentiation*, though the absence or very slight character of the fever and other constitutional symptoms aid us in making a differential diagnosis.

I pass over typhus fever, glanders, the first stages of typhoid fever, and other diseases without more than mentioning them and make no attempt to draw a strict differential diagnosis. A brief review now of the symptoms of smallpox may be of interest.

Smallpox may appear in any form, from the mild varioloid, which is smallpox modified by vaccination, up to the hemorrhagic form. The forms as usually described are variola vera or true smallpox, the discrete form, the confluent, and the hemorrhagic form, which may occur as the purpuric form and a hemorrhagic form, in which hemorrhage takes place into the pocks or from the mucous membrane.

The invasion of smallpox begins suddenly, and is usually ushered in with a chill. It may or may not be followed, but usually is attended, by severe aching in the small of the back and limbs, sometimes with intense headache, always with vomiting and with a fever reaching 103° to 104° F. The pulse is rapid and strong. Convulsions may occur in children. There is an initial rash, which usually appears on the second day, in the form of a definite redness. According to Osler, in about 13 per cent of the cases there is an initial rash on the inner surface of the thighs, the lateral surfaces of the thorax, the lower part of the abdomen, and occasionally on the anterior surface of the knees and the inner surface of the elbows.

In the discrete form of smallpox the eruption usually appears on the third day at the margin of the hairy scalp, around the mouth, and on the wrists. At this point, to be thoroughly noted, the temperature, which up to this time has been high, falls to nearly normal. Within twenty-four hours the eruption becomes general over the body, and at this stage of the disease there is a strong resemblance to measles. On about the fourth or fifth day of the disease the eruption becomes papular, and there is noted by passing the fingers over the surface a shotty sensation, viz, as if small shot were embedded under

the skin. About the sixth day these papules become vesicles, which vesicles change to pustules. The stage of pustulation is attended with a sinking in the center of the pustules, or umbilication, and each pustule is surrounded by a red border. This ushers in the stage of suppuration and the secondary fever comes on, the temperature rising again rapidly and being strictly a fever of suppuration. It is not infrequent that the eruption makes its appearance on the mucous membrane of the throat, fauces, and pharynx twenty-four hours before its appearance upon the cutaneous surface.

About the twelfth or thirteenth day of the disease the pustules begin to dry up and form scabs. These scabs fall off in the order of their appearance upon the body. The temperature falls, soon reaches normal, and convalescence begins.

In the confluent form the initial symptoms are more intense and the eruption may occur a little earlier. The papules are discrete, but the vesicles and pustules coalesce, especially upon the face, hands, and feet, and there is, of course, a great deformation and swelling of the face, and there is swelling of the lymphatic glands, salivation, possibly diarrhea, and almost always acute albuminuria.

I feel that this description is brief to a point of meagerness, but it must be apparent to you, gentlemen, that a week could be easily spent in a minute description of all the clinical features of smallpox, and even then leave the subject improperly described.

Vaccination.—I have already gone into the technique of vaccination. Vaccination should begin naturally with the "contacts," or those who have been exposed directly to the infection from the first-declared case of smallpox. The area of vaccination should be greatly extended, and if the disease threatens to spread vaccination in a community should be general. The question may be pertinently asked, what should be the practice in regard to the repetition of vaccination. I think it admits of little doubt that the community should be vaccinated and revaccinated until everyone is either protected by vaccination, or it has been demonstrated beyond peradventure that individuals are not susceptible to vaccinia. There are quite a number in this latter class. In my personal experience I know of one who was vaccinated successfully in infancy, revaccinated at the age of 8; vaccination was unsuccessfully attempted again at the age of 11, and since that time he has been vaccinated more than thirty times with only one rather imperfect "take." I have seen other instances equally conclusive. It is also reasonable to suppose that a person or persons susceptible to vaccination are to some extent susceptible to smallpox, though the course of smallpox will usually be modified even by one successful vaccination.

It would seem reasonable, therefore, that vaccination to be absolutely efficient should be repeated from time to time until a complete

immunity against it is acquired. This, it is natural to suppose, would lead to an equally complete immunity against smallpox, though this remains to be demonstrated.

I do not propose, before this audience or at this time in the world's history, to defend the subject of vaccination. I confess it with shame that there are some, even in the medical profession, who cast discredit upon the efficiency of vaccination as a protective measure against smallpox. Is it surprising, then, that there should be a comparatively large number among the many millions of inhabitants of the United States and of some other countries who doubt the expediency of the process and invoke law, sentiment, and legislation to prevent the performance of compulsory vaccination?

Management.—We now take up the consideration of the management of individual cases of smallpox from a point of view purely sanitary and prophylactic—that is to say, to prevent its spread.

I do not know what the law in all States is. I do not know whether under your law the health officer is authorized and empowered to remove every case of smallpox to a special contagious-disease hospital for treatment. Please note that I use the term “contagious-disease hospital.” I protest with all my power against the term “pesthouse.” Is it surprising that persons stricken with smallpox object to being removed to a “pesthouse?” The nature of the disease is sufficient in itself without the addition of this terribly sounding word, “pesthouse,” by which it is assumed that the person who is being removed is loathsome, dangerous, and an object to be shunned alike by his friends and the general public. Certainly if the community is provided with a well-built, well-administered, comfortable, contagious-disease hospital the case of smallpox had better be removed there, but if this be not so, or if the objections of the patient's friends or family can not be overcome, or if he have law upon his side forbidding his removal otherwise than by his own free will and consent, it goes without saying that the case should be carefully isolated in his residence, preferably upon the upper floor, and that the floor of the house upon which the disease is to be treated should be abandoned by the rest of the family and placed in strict quarantine.

Sanitation and disinfection.—The room should be prepared by having all unnecessary furniture, curtains, hangings, or draperies removed. It should be upon the sunny side of the house and at the same time capable of being darkened, should be freely ventilated, and be maintained at an equable temperature. All bed linen, garments, handkerchiefs, towels, etc., worn or used by the patient and soiled by him should be immersed in a solution of carbolic acid, 5 per cent, or a solution of chlorinated lime, 2 ounces to the gallon of water, for one hour, and after this immersion they should be boiled and then laundered, aired, and sun dried. The dishes, cups, medicine glasses, eating uten-

sils, etc., used by the patient should be immersed in actually boiling water. Food that has been in the sick room and which is not consumed should be burned, either in a stove in the room or, after being covered with a towel wet with one of the above germicidal solutions, should be removed from the room and burned in a stove or fireplace.

As I said before, the room, or preferably the floor, of the house should be in strict quarantine. The patient should be seen only by his attending physician and nurse. The nurse should wear easily washable garments, which should be treated in the same way as the bed and body linen of the patient. The physician after his visit should change his outer clothing before mingling with other patients or the public.

We will suppose that a case goes on to a favorable termination. What should be done upon its conclusion? It must be remembered that smallpox is communicable so long as there are any scales about the patient, and even further—so long as there are any minute scales or epithelium desquamating from the bottom of the pocks or retained in the hairy scalp. The patient, therefore, after the stage of desquamation begins, should receive frequent mild antiseptic baths, paying especial attention to the hairy scalp, and should not be considered as safe until a careful examination of the pocks shows that the epithelium or skin at the bottom of the pocks is smooth and shows no tendency to desquamate. Special attention should be paid to the throat, mouth, and nose of the patient. These should be washed or gargled with a mild antiseptic solution, and any towels or cloths which are used to receive the secretions of the mouth and nose had better at once be burned; it is useless to go to the trouble of disinfecting them, as is provided in the case of clothing, either bed or body.

These precautions having been observed, the patient being convalescent and the desquamation completed: what should be done with the room? The answer is, It should be completely disinfected.

The methods adopted for this disinfection will vary much with the circumstances. Provided that the room prior to being occupied by the smallpox patient has been stripped of all unnecessary furniture, hangings, and draperies, much may be accomplished by washing the walls and floors of the apartment with water as near boiling as possible to which has been added a liberal quantity of ordinary carbonate of soda, which should be used in the proportion of about half a pound to 3 gallons of water. All woodwork about the room and the bed, if a wooden one, should be washed with this solution. If the walls of the apartment are papered, this paper had better be torn down, the walls scraped, and the paper replaced with new after the apartment has been disinfected by burning sulphur in the room in the proportion of about 3 or 4 pounds per 1,000 cubic feet of space, care being taken to thoroughly close the room and render it as near air-tight as

possible and at the same time to volatilize or evaporate water to the extent of half a pint at least per 1,000 cubic feet. This is necessary for the reason that sulphur burned in a dry atmosphere has very feeble germicidal properties, but when hydrated so as to form sulphurous acid (H_2SO_3) the germicidal effect is much increased, though the penetrating power of the gas is small. The mattress that has been used by the patient, if a cheap one, had better be burned, it being wrapped in a sheet wet with the carbolic or chlorinated lime solution before being carried out of the house. The burning should be accomplished under supervision, and should be absolute and thorough, because, if not, it may be removed by some careless or innocent person and the spread of the disease thus incurred.

Disposal of the dead.—It is a melancholy fact that while the mortality attendant upon smallpox has of recent years much diminished, our art, nevertheless, is sometimes impotent and death results. What should be the disposition of the remains? The body had better be wrapped without preliminary washing in a sheet, or two or three sheets, wet with a strong germicidal solution, such as carbolic acid, chlorid of lime, or bichlorid of mercury 1:1,000, and be immediately placed in a metallic or other hermetically-sealed coffin. It goes without saying that there should be no attempt at a public funeral. Any funeral services held over the remains had better be conducted in private, and there should be the least possible exposure of persons and the things in the house to the patient or his attendant.

If it be possible, or the sentiment of the community or family be not opposed to it, cremation should be practiced. I am aware that this is fraught with many difficulties, but simply throw out the suggestion for what it is worth.

Epidemics.—Now, suppose that in spite of our efforts the disease spreads. What should be our course? If there are large numbers of patients, it will be most essential that a contagious-disease hospital should be opened in the community. This should be in an isolated spot, and should be maintained in absolute quarantine. The attending physician had better become a resident during the continuance of the epidemic. The nurses and other attendants about the hospital should be interdicted from passing beyond the quarantine limits, and any necessary supplies for the use of the hospital should be deposited at a safe distance and carried into the confines of the institution without any personal intercourse with the outside world.

Cases should be sought for; they should not be waited for to declare themselves. "Contacts" should be vaccinated and revaccinated, as already stated, and the vaccination and revaccination should be conjoined with a house-to-house inspection made at intervals corresponding to the period of the incubation of the disease, say every ten days.

This brings up the question, What should be the treatment of "con-

tacts?" My views on this question may be different from those held by some of you; but, believing as I do that smallpox is not communicable until the appearance at least of the preliminary rash, I should say that if it be possible to keep the contacts under observation they need not be quarantined after having been successfully vaccinated. Arrangements should be made for keeping them under observation from day to day, but until they manifest some initial symptom of the disease, as fever, chill, headache or backache, nausea or vomiting, it is not necessary, in my opinion, to quarantine them. Of course if a contact refuses vaccination that contact should be placed in strict quarantine during the incubative period of the disease, and, this passed, should he again refuse vaccination he should be kept under an observation which will insure him doing a minimum of damage to the community in which he is resident.

Additional remarks on disinfection.—We have discussed already the disinfection and purification of the individual room in which a case of smallpox has occurred, but I feel that I would be derelict if I dismissed the subject of disinfection in this curt manner. Suppose that the disease has assumed an epidemic form in a community—that is to say, smallpox spreads and possibly the connection between cases is lost, viz, there is no definite history as to where the case under consideration acquired its infection—disinfection will then be required of, first, the infected premises; second, the person and his belongings; third, disinfection of vehicles, such as railway coaches in which persons suffering with smallpox may have been conveyed; and fourth, possibly, the disinfection of merchandise shipped from a place in which smallpox prevails; and finally, and fifth, disinfection of mails.

In the matter of premises: On the removal of a patient from the house or apartment in which he has developed smallpox, it is always better to have the contents of the room remain *in situ* while a preliminary disinfection with sulphur or with formaldehyd gas is given. The object of this is to reduce to a minimum the danger in handling articles likely to convey infection preliminary to their final and complete sterilization. The room and its contents, as has already been said, may be disinfected with sulphur or formaldehyd gas, and the contents of the room, bedding, etc., by burning, by boiling, or by steaming in a special apparatus where facilities for these processes are available.

The formaldehyd may be applied in several ways, either by an apparatus producing formaldehyd direct by the partial oxidation of wood alcohol, by evolving the gas under pressure in an autoclave from one of its commercial solutions which are known as "formalin," "formol," "formolose," etc., or by sheets sprinkled with one of these solutions hung in the apartment to be disinfected, the room being tightly closed. For the production of formaldehyd gas from wood alcohol 24 ounces

of wood alcohol should be oxidized for each 100 cubic feet of air space of the room. In using the autoclave 10 ounces of formalin (40 per cent solution), to which has been added 20 per cent of a neutral salt, such as calcium chlorid, borax, etc., should be used per 1,000 cubic feet. For the sheet or sprinkling method 10 ounces per 1,000 cubic feet (40 per cent solution) should be sprinkled upon the sheet suspended in the apartment tightly closed. In using the sprinkling method it is essential that the sheets or cloths should not be wet or wrung out of the solution, but that the solution should be so sprinkled as to remain in small drops without coalescing, and thus furnish the largest space possible for evaporation.

I have mentioned sulphur dioxid and formaldehyd as disinfecting agents, and it might be well here briefly to discuss the limitations of each.

Sulphur dioxid is especially applicable to the holds of vessels, to freight cars, to apartments that may be tightly closed and which do not contain objects injured by the gas. It bleaches fabrics or materials dyed with vegetable or aniline colors. It destroys linen or cotton goods by rotting the fiber through the agency of the acids formed. It injures most metals.

On the contrary, formaldehyd gas has the advantage that it does not injure fabrics or colors, except, perhaps, the most delicate. It is not fatal, however, to the higher forms of animal life, though germicidal to the ordinary forms of bacteria, especially those of the non-spore-bearing varieties. It is effective in a minor degree against spore-bearing bacteria, such as anthrax, tetanus, etc. It is applicable to the disinfection of rooms or clothing and fabrics. It is to be borne in mind that commercial solutions do not contain a full 40 per cent of formaldehyd gas, and that all of them are apt to deteriorate with time. A quantity in excess of the amounts prescribed should therefore be used in disinfection unless the full strength of the solution has been determined by recent reliable analysis.

A comparison of the three methods of using formaldehyd may be of interest. The lamp or generator is easy of application and requires no amount of mechanical skill. The apparatus is heated for one and one-half minutes by igniting the alcohol. The flame is extinguished, and the oxidation of the alcohol then proceeds by means of the platinized surfaces contained in the lamp. The gas is produced regularly in a form very active and destructive to bacterial life, and is not prone to a change of form or polymerization. The process by this method requires six to eighteen hours exposure, depending upon the size of the room and the nature of the contents. The sole disadvantage of the lamp is that the gas is produced rather slowly, but it leaves little or no odor when applied to clothing and textiles. The articles to be disinfected should be suspended in a tight room, and so disposed as to

permit free access of the gas. The wood alcohol used should be of 95 per cent strength, and should not contain more than 5 per cent of acetone.

The autoclave process has the advantage that the gas is evolved rapidly, but the autoclave is in fact a steam boiler operating under considerable pressure, from 45 to 60 pounds per square inch. It is somewhat liable to get out of order, requires a considerable degree of mechanical skill to operate it, and is prone to rapid deterioration. A further disadvantage of the process is that the gas evolved is exceedingly prone to polymerization into paraform or trioxymethylene, and this polymerized product, combined with the neutral salt, calcium chlorid, or borax, which it is necessary to use, leaves a disagreeable odor upon fabrics or garments submitted to its action. The paraform deposited has a tendency to volatilize upon every elevation of temperature, evolving further quantities of formaldehyd gas, which is irritating to the eyes and respiratory mucous membranes.

The limits of either of these processes as to size of rooms, buildings, or apartments to be disinfected have not yet been accurately worked out, though the matter will be taken up shortly; but it is known that for rooms such as are found in an ordinary dwelling house both methods are efficient, and experiments have shown that this efficiency extends to apartments of very considerable dimensions.

The spraying or sheet method of formaldehyd disinfection gives unequal results, and should only be used in the absence of the apparatus mentioned above.

We have already discussed disinfection of clothing, bedding, and the articles used in the treatment of the sick. Where these are of value they should be boiled or steamed. When not of much value they had better be burned without further delay.

The dejecta of smallpox patients should be disinfected in carbolic acid solution, 5 per cent, tricresol, 1 per cent, or a solution of chloride of lime, or milk of lime. If smallpox has declared itself in a person during transit on a railway or other public conveyance, no article used by him should be thrown away *en route*, but they should be gathered, kept as carefully as possible, and at the end of the journey be disinfected or burned. Railway coaches may be disinfected as well as sleeping cars by any of the methods given for the disinfection of rooms, but particularly by means of formaldehyd gas, using the generator for direct production of gas from wood alcohol, or the autoclave.

The disinfection of merchandise is seldom if ever required, as no merchandise is perhaps infected. Surface disinfection, at most, is all that would be required, and for this sulphur dioxid or formaldehyd by any of the methods given, is ample.

The mails emanating from an infected locality should be disinfected by formaldehyd, or by sulphur dioxid; methods for accomplishing which disinfections have been prescribed by the Post-Office Department.

SCARLET FEVER.

I am going to ask your permission to depart from the order of the caption laid down in my address and take up next the subject of scarlet fever, for the reason that in certain important particulars there is a strong analogy between smallpox and scarlet fever.

Beyond doubt smallpox is caused by a specific germ. Of the nature of that germ we are as yet uncertain in spite of the recent discoveries of Councilman, but in all probability it is a protozoon and not a bacterium. The same statement applies to scarlet fever. We do not know as yet the specific cause of scarlet fever, though it has been attributed both to protozoa and bacteria. Time will not permit that we should go into the consideration of scarlet fever with even that degree of minuteness with which we have treated smallpox, incomplete though that treatment has been.

Symptoms.—Scarlet fever is a highly communicable disease. It is probably to be accepted as the type of a communicable disease, and the infection, using the term in its broadest sense, is, while not very resistant, quite long lived. It is usually a disease of childhood, though it may attack adults at any time of life. The reason for the communicability of scarlet fever is that it is a disease attended by very extensive desquamation, amounting in many instances to a complete peeling of the cutaneous surface of the body, and the infective principle, whether it be bacterial or protozoal, is conveyed in these scales or particles. In addition, the contagion or infection of scarlet fever can also be communicated by the nasal and buccal secretions, and as scarlet fever is always attended by more or less sore throat, this sore throat being a very severe and a most prominent symptom in some cases, it is a disease of easy spread unless stringent precautions are taken.

It is also very possible that the disease may be conveyed by the other secretions of a scarlet fever patient, such as the urine and feces, also, possibly, the vomited matter, though this may result from the fact that the vomit has passed through an infected throat.

Scarlet fever being, as has been intimated, usually a disease of childhood, it is to schools, public or private, that we must look primarily as a means for the dissemination of the disease in a community. Unfortunately, we are not at this time in possession of a prophylactic measure against scarlet fever as we are in vaccination against smallpox. Therefore, we are not able by one general method to prevent the spread of the disease. I think, therefore, it is fair to assume that,

given a case in which scarlet fever has appeared among the pupils of any school, it would be well either to close that school or to make frequent—possibly daily—inspections of the health of the rest of the scholars. This inspection should take into consideration the general condition of the child, whether he presents suspicious symptoms—complains of sore throat—or presents evidence of a commencing infection of any kind, as is noted by the symptoms of a bad cold, suffused eyes, or a coryza.

Sanitation and disinfection.—The sanitary treatment of scarlet fever in a household should be upon the same general principles that have been outlined in the case of smallpox. The patient should be kept in an isolated room, preferably in the upper story of the house, and should be guarded from contact with all save those absolutely necessary to care for him, his physician and nurse. It is not our purpose to follow the clinical course of the disease, but during the height of the disease care must be taken to disinfect all discharges from the patient, especially the secretions from the nose and mouth; secondly, from the bowels and bladder, but it is only when the height of the disease is past and the brilliant scarlet eruption gives place to a commencing desquamation that the real trouble begins. This desquamation is a natural process and must go on. The outer layers of the skin have been rendered dead by the disease and must be eliminated, and so long as this desquamation continues the patient is a dangerous object and a source of infection to others. During the peeling or desquamatory stage of scarlet fever the patient's skin should be bathed once or twice a day with a germicidal solution. A weak solution of carbolic acid, not exceeding 1 or 2 per cent, should be used to bathe the entire body surface, and especially the hairy scalp. The use of carbolic acid for children under 10 years of age is not unattended with danger; therefore some other antiseptic sufficient in power but mild in character may be substituted. A saturated solution of boric acid is a good one, and it is well that this solution be rendered decidedly alkaline by the addition of a small quantity of carbonate of soda. The throat should be gargled frequently and the nose cleansed with a mild antiseptic. Boric acid is probably the best solution for this purpose.

So long as a single scale is visible about the skin or upon the scalp of the child so long is the child capable of conveying infection, and should not be released from quarantine until this process is entirely at an end.

The same care should be taken with the bed and body clothing of the patient as was recommended in smallpox.

Articles of value should be boiled or immersed in a strong germicidal solution. The carbolic-acid solution is here good, or, if facilities are available, they should be thoroughly disinfected by steam. In removing the articles from the sick room to be either boiled, burned, or

steamed care should be taken to envelop them in a sheet wrung out of one of the strong germicidal solutions.

A great source of the spread of scarlet fever has been the fact that the books, toys, or other articles used for the amusement or entertainment of the patient are not disinfected at the end of the sickness. If these toys or books or playthings are of little value, they had better be burned. If value is attached to them, either by their intrinsic worth or by association, they may be disinfected at the end of the illness by sulphur dioxid, by formaldehyd used by any of the methods prescribed as for smallpox, or, if permissible, by immersion in one of the strong germicidal solutions.

I do not intend again to go over the whole subject of disinfection with the minuteness with which I treated of it in the case of smallpox. Any one of the methods outlined in the treatment of that disease is applicable to disinfection after scarlet fever. I attach particular importance to formaldehyd because sulphur dioxid is destructive and injurious to fabrics and textiles. Particular attention should be paid to the walls and to cracks and crevices of the sick room. The quantity of epithelial detritus which results after an attack of scarlet fever is great beyond all belief, and so long as this is not reached by a disinfecting agent the room is dangerous for occupancy by others who are not already protected by a previous attack of the disease. Great attention should therefore be paid to washing the floors and scrubbing the walls of the apartment. If care has been taken in the early stages of the illness to remove all unnecessary articles from the room, an excellent plan would be to subject the room to a preliminary disinfection by sulphur dioxid, this to be followed by a scrubbing with a strong soda solution and a subsequent application of formaldehyd gas by any one of the three methods which have already been brought to your attention.

Concluding remarks.—I feel that I have dismissed this part of the subject briefly, but I do not wish it to be considered alone by what I have said, but rather by what I have referred to in the previous account of measures to be taken for the prevention of smallpox.

Isolation and disinfection are, therefore, our greatest safeguards in the prevention of the spread of scarlet fever, and these measures may, in the discretion of the health officer, with advantage be supplemented by house-to-house inspection, as has been recommended in the case of smallpox, and the immediate isolation of all children or adults who present the initial symptoms of the disease.

DIPHTHERIA.

The time at our disposal being short, I am going to pass on to the subject of diphtheria.

Etiology.—Diphtheria is an acute, specific, communicable disease caused by infection with the Klebs-Löffler bacillus. It is unnecessary

to point out to you at this day that the principal local symptoms of diphtheria are referred to the throat, where they are made manifest by the exudate or false membrane, highly fibrinous in character, which has given the disease its name, from the Greek *σφθέρα*, skin. It is to be distinctly understood, however, that diphtheria is to be regarded as a local infection with constitutional manifestations, the local being manifested in the throat, the larynx, and, in many cases, in the nasal passages. The disease is a distinctly bacterial infection whose degree of communicability is very great. The virulence of the organism varies and also the degree of susceptibility of different persons. The infectious agent is the Klebs-Löffler bacillus, and this is contained in the secretions of the mouth, throat, and nose, and may also be sometimes present in the blood, causing a true septicemia, and may, in exceptional cases, be contained in the bladder and fecal discharges of the patient.

Prevention.—In the matter of prophylactic measures diphtheria must be considered as occupying a medial position between smallpox—against which there is a well-recognized protection—and scarlet fever, for which we have as yet no well-authenticated prophylaxis. It is needless for me to bring to your attention that most wonderful discovery of the nineteenth century, the diphtheritic antitoxin, announced conjointly and at the same meeting of the International Medical Congress by the two eminent scientists, Behring, of Frankfort, and Roux, of Paris.

In the diphtheritic serum we have an agent of wonderful properties, an agent that has reduced the mortality to a degree which will ever render these two scientists the admiration of the scientific and lay world, and in the same agent we have at our disposal a measure of distinct prophylactic value.

I do not think it is necessary in this gathering to go into the subject with great minuteness; but, as in the case of scarlet fever, schools, public and private, and congregations of children for purposes of instruction or amusement are agents for the dissemination of the disease. A school in which diphtheria has made its appearance in the person of one or more pupils should be closed until thorough measures of disinfection can be applied to the building, and during the period of incubation of the disease it would be decidedly advantageous to have all pupils of the school subjected to a thorough and oft-repeated medical inspection, particular attention being paid to the general condition of the children and more especially to the condition of their throats and of their nasal mucous membranes. Every case of sore throat, mild or grave in character, should be subjected to bacterial diagnosis, and whether the symptoms are urgent or not every child or adult presenting suspicious microscopical forms in their throats as a result of these cultures should be isolated until the

disease is frankly announced or until suspicion is removed. These examinations should be frequently and thoroughly repeated.

Sanitation and disinfection.—The sanitary treatment of individual cases of diphtheria should be conducted upon the general lines given for scarlet fever. The patient should be isolated in a room, and there should be no communication with the patient except on the part of necessary attendants, nurses, and the physician. The danger being in the Klebs-Löffler bacillus being contained in all the secretions of the mouth, throat, and nose, it is obvious that these secretions should be thoroughly disinfected as soon as eliminated, and that clothes, handkerchiefs, etc., used to receive them should be either thoroughly disinfected or promptly burned. I am decidedly in favor of burning. The same measures apply to the bed and body clothing of the patient as apply in the case of smallpox or scarlet fever—they should be disinfected either by burning, boiling, or by steam.

I do not intend here to enter into the treatment of diphtheria by the administration of antitoxin, but I do distinctly place myself on record as saying that the physician who neglects to employ antitoxin in the treatment of the disease lays himself open to criticism and deprives his patient, child or adult, of the very best means known to modern science in the cure of a dreadful malady. The question of immunizing contacts by doses of the prophylactic serum is one that the physician must decide for himself, and in this he must be governed largely by the prejudices of the parents and friends of his little patients. Speaking for myself, I should say that given a large family—especially one in which children predominate—it would be the wisest measure to administer a prophylactic dose of diphtheria antitoxin. It can do no possible harm and may be the means of averting an attack of diphtheria and of preventing the spread of the disease beyond the house in which it first appeared.

The same general principles as to the disinfection of articles in the sick room and the sick room itself as given for scarlet fever and smallpox apply to diphtheria. Especial attention should be paid to the drinking vessels and eating utensils, and these should always be thoroughly sterilized with actual boiling water. On no account should food which has been exposed in the room of a scarlet-fever or diphtheria patient be used by anyone else, but it should be promptly destroyed. Again, in both scarlet fever and diphtheria we are confronted with the possibility that all of our efforts to cure disease and to prolong life may be inefficient. The same measures given in the case of scarlet fever and smallpox should be taken in regard to the disposal of the remains of the deceased. They should be wrapped in sheets wet with a strong germicidal solution, the body at once closed in a hermetically sealed coffin, and burial should be prompt. There should be no

attempt at anything partaking of the nature of a public funeral. 2s in the case of smallpox, cremation would be advisable did facilities exist and the prejudices of friends and relatives permit.

CONCLUSIONS.

I am going to bring this address to a close without further comment. I have already said much, though much also remains to be said.

The three subjects committed to me for discussion are so vast that volumes might be written upon their management, but the time allowed me is that given to an ordinary address, and this time I am afraid I have exceeded. I shall lay down certain axioms for your consideration and then close:

1. In the case of smallpox, *vaccinate, isolate, and disinfect.*
2. In the case of scarlet fever, *isolate and disinfect.*
3. In the case of diphtheria, *isolate, administer antitoxin, and disinfect.*

Had I said nothing more than to give these three closing remarks I would have covered the subject, giving you these cardinal principles, and leaving to your intelligence and experience the methods of carrying them out.